

Upper Mississippi River Nine-Foot Channel Project,
Lock and Dam Complex Number 12
Spanning the Upper Mississippi River between
Bellevue, Jackson County, Iowa
and
Jo Davies County, Illinois

HAER No. IA-24

HAER
IOWA,
49-BEL,
1-

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
Rocky Mountain Regional Office
National Park Service
U. S. Department of the Interior
P. O. Box 25287
Denver, Colorado 80225

HISTORIC AMERICAN ENGINEERING RECORD

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Location:

Located in the Upper Mississippi River, adjacent to downtown Bellevue, Iowa, and 556.7 river miles upstream from the confluence of the Ohio and Mississippi rivers. The complex stretches across the river at a point where the bluffs on the Iowa side are very close to the river, while a complex of islands and sloughs extends nearly three-fourths of the way across the river from the Illinois side. Bellevue State Park occupies the high ground on the highest bluff on the Iowa side, while the urbanized area of town extends to the government-owned property on the flat land below the bluff. The federal Savannah Army Depot occupies the islands, slough, and small flat bottom areas on the Illinois side. The esplanade adjoins the Iowa shore, the lock is just riverward of the esplanade with the movable section of the dam tying to the easternmost lock wall. The earthen embankment section of the dam extends from the movable section of the Illinois shore. Corps Drawing Numbers M-L 12 10/5, 10/6, 110/9A; HAER Photographs Numbers IA-24-1 through IA-24-23.

Dates of Construction: 1934-1938

Present Owner: U. S. Government
Rock Island District
Corps of Engineers

Present Use: River navigation/hydrology control

Significance: The U. S. Army Corps of Engineers Nine-Foot Channel Project (1927-1940) represents the culmination of a 100-year effort to improve the navigability of the Upper Mississippi River between the mouth of the Missouri River and Minneapolis, Minnesota. This specific project arose as a response to the farm crisis of the 1920s. Proponents of the New Deal adopted the project and gave speed to its construction as a means of providing public employment during the more general depression of the 1930s. By the 1940s, the completed project had converted over 650 miles of free-flowing river into a series of interconnected reservoirs which ensured enough water for fully loaded modern boats and

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barges to navigate the system. This constituted a significant alteration of the natural environment of the Upper Mississippi River. However, the project also brought economic benefits to the communities along and around the river corridor and lead to new recreational opportunities for the entire region.

The Upper Mississippi River Nine-Foot Channel Project inaugurated a new development in slack-water navigation system dam practice in the United States: the adoption of a non-navigable dam containing both roller and Tainter gates. Prior to the Corps' 1930 decision to build non-navigable dams on the Upper Mississippi River, United States Army engineering practice had, nearly universally, been to construct navigable dams, permitting open-river navigation at higher river stages. By 1930, European engineers had been using roller gates in dams extensively for over 25 years. However, only ten such structures had been built in the United States, and these were all located on reaches of rivers where ensuring navigability of any sort was not a design concern. It was not until 1925-1926 that civilian engineers pioneered the use, in the United States, of roller gates in combination with other types of gates. Most of the Corps' Upper Mississippi River project dam designs expanded upon this development, incorporating both roller and Tainter gates. The Corps' shift from navigable to non-navigable dams demonstrate the influence of shipping techniques on navigable waterway improvement technology. It also exemplifies the cautious nature of American Army engineers response to changes in shipping. The Corps' choice of this particular type of non-navigable movable dam illustrates the influence of the hydraulic characteristics of individual rivers on the selection of waterway improvement technologies. It also evidences the manner in which critical engineering design developments are disseminated and become accepted.

Ironically, the Upper Mississippi River Nine-Foot Channel Project also resulted in the obsolescence, by the project's end, of combination roller and Tainter gate dams. Technological advances resulting from the research and development incidental to the design and construction of the 26 lock and dam systems in this project enabled U. S. Army Corps of Engineers to develop both submersible and non-submersible Tainter

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gates which nearly matched the capabilities of the roller gates. Once these less expensive and easier operated and maintained gates had been developed, American engineers ceased designing or constructing combination roller and Tainter gate dams. The Corps' creation of a new dam type and its subsequent obsolescence during the course of a single project dramatically illustrates both the evolutionary nature of American engineering in general and the Nine-Foot Channel Project in particular (Text, pages 11 and 49-50. See HAER No. IA-23 for complete history, footnotes and bibliography).

Historian:

Mary Yeater Rathbun

August 1988

PART I. HISTORICAL INFORMATION

A. Physical History:

1. Dates of Erection: 1934-1938
2. Architect/Engineer: U. S. Corps of Engineers, Rock Island District
3. Original and Subsequent Owners: U. S. Government--Rock Island District, Army Corps of Engineers
4. Builders, Contractors, Suppliers:

General Contractor--Lock and Central Control Station Construction:
James Stewart Corporation, Chicago, Illinois (subsidiary of James
Stewart and Company, Inc., New York, New York.

Subcontractors:

E. A. Whitney & Sons, Inc.	Driving of steel and timber piling Kansas City, Missouri
McClintic-Marshall Corps.	Fabrication, erection and placement of all structural steel: miter gates, tainter valves, castings, operating machinery, handrailings, rubber seals, etc.
Henry Knudson and Company.....	Cleaning and painting all steel and Chicago, Illinois machinery, painting oak timber gate fenders and central control station
Connors Plumbing, Heating.....	Furnished and installed plumbing, and Ventilating Company heating and drainage system in central control station
Henschel Roofing Company.....	Placed roofing, flashing and gutters on central control station
C. C. Putnam.....	Placed portion of riprap
Beckman Painting Corporation.....	Painted miter gates, tainter (as a subcontractor to valves, and grating McClintic-Marshall Corp.

General Contractor--Dam Construction: Warner Construction Company,
Chicago, Illinois

Subcontractors:

Treadwell Construction Co.	Furnish all steel work for roller Midland, Pennsylvania and tainter gates, service bridge and crane trolley
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Oscar Daniels Company.....Erect all steel work for roller and
Erie, Pennsylvania tainter gates, service bridge and
crane trolley
S. Morgan Smith Company.....Fabricate tainter and roller gate
York, Pennsylvania operating machinery
Commonwealth Electric Company.....Furnish and install electric
St. Paul, Minnesota wiring , install exposed electric
conduit, heaters, switches,
controls, etc.
A. M. Sproule.....Clearing and grubbing
Galan, Illinois
Fugina and Dresser.....Placing crushed stone, one-and-two-
Winona, Minnesota man stone and riprap protection on
submersible and non-submersible
section of dike embankment
Henry Knudson.....Filed painting of exposed metal
St. Paul, Minnesota work
Dubuque Roofing Company.....Furnish materials and place
Dubuque, Iowa built-up roofing on pier house
James W. Ledferd d.b.a.Cleaning and painting metal work
Ledferd Decorating Service

General Contractor--Power, Control, and Lighting System
Construction: Federal Engineering and Construction Company, Kansas
City, Missouri

Subcontractors:

Superior Iron Works.....Provided the haulage units
Cutler-Hammer Inc.Installed the haulage units
Milwaukee, Wisconsin

General Contractor--Esplanade Construction: Green Construction, Des
Moines, Iowa

5. Original Plans and Construction:

U. S. Army Corps of Engineers, Rock Island District, plans for lock
submitted by associate engineer E. E. Abbott. By the time he
submitted the plans for the dam, Abbott had been promoted to senior
engineer.

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6. Alterations and Additions:

<u>Item</u>	<u>Year</u>
Land wall and lock gate handrails lowered by one rail and new handrail made from salvaged materials installed on both edges of each lock wall and on upstream side of walkways on top of lock gates	ca. 1945
Construction-handrail on upstream side of dam service bridge	ca. 1955
Addition-Mooring facility	1951
Construction-frame air-lock vestibule at upstream end door of central control station	ca. 1960
Addition-boat launches on lock walls	ca. 1970
Replacement-haulage units	ca. 1972
Removal-Lockmaster/Assistant Lockmaster residences from esplanade	ca. 1975
Removal-standby generator for machinery room of central control station	ca. 1975
Construction-emergency generator building	ca. 1975
Replacement--wooden plank hatches on dam service bridge with aluminum ones	ca. 1979
Installation-traveling mooring kevels extending length of guidewalls of lock	1980
Construction-new workshop building	ca. 1980
Construction-concrete, metal, and fiberglass covers over machine pits on main lock	1983
Replacement-crane on dam	1983-1984
Replacement-light posts and light fixtures around lock	1984

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Replacement-exterior wall covering of central control station and frame air-lock with brick one incorporated into main building	1985-1986
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B. Historical Context:

The special board of engineers did not see the construction of Lock and Dam Complex 12 as a high priority in 1931 and placed it in the third group of projects to be constructed. The James Stewart Corporation began building the temporary buildings and remodeling the residence it was to use as an office for its lock construction on February 24, 1934.

Most specific items of engineering significance at this complex relate to the dam. The Rock Island District designed Dams 12 and 21 concurrently. The district incorporated innovations in this pair of dams, the third group it designed after Dam 20 and after Dams 11 and 18 (also done as a concurrent pair). Having received a promotion during the two-month interval between completing the design for Dam 11 and completing the first of this pair of designs, Rock Island District senior engineer E. E. Abbott submitted the completed plans for Dam 12 in November 1935 and those for Dam 21 in September 1935. Construction, however, did not begin on either Dam 12 or 21 until nearly a year later. Work began on both of these dams in August 1936, at which time work also began on Dam 22 (Abbott had completed the design for this dam in April 1936). Dams 12, 21 and 22 were the first in the Rock Island District to employ 2b roller gate piers as they were all apparently initially designed, but the piers were not completed before the Rock Island District changed the design, so that the open space which would have appeared below the pier bouse was filled with a steel diaphragm.

The dam system consists of 7 2b-type Tainter gates, three submersible roller gates, two non-overflow earth and sand-filled dikes, two transitional dikes, and a concrete-covered ogee spillway submersible earth and sand-filled dike. Foundations are set in sand, gravel, and silt. Lock dimensions are the standard 110 feet by 600 feet, with additional footings for an auxiliary lock of standard dimensions. Lock lift is 9 feet. Normal upper pool elevation is 592.0; this is about 15 feet above the tail waters below the dam at low water. When both pools are at their normal depth, the difference is reduced to 9 feet or less.

The lock and dam elements of the complex took about four and a half years to complete, at a cost of \$5,621,000. During the peak of construction, a maximum of 960 men were employed at one time. The complex was placed in operation as a unit of the Upper Mississippi River navigation system on May 14, 1939. It was the fourth of the 1931-1940 Upper Mississippi River Nine-Foot Channel Project complexes in the Rock Island District to go on line.

PART II. TECHNOLOGICAL INFORMATION - LOCK

A. General Statement:

1. Design Character: Standardized Ohio-Mississippi Lock Design. Drawing Number M-L 18 20/1.
2. Condition of Fabric: Good.

B. Description of General Layout and Principal Elements:

1. Overall dimensions: Main lock chamber - 110 feet wide by 600 feet long by 40 feet high; adjoining incomplete auxiliary lock chamber 110 feet wide by 40 feet high. Lift - 9 feet. Drawing Number M-L 12 20/1.
2. Foundations: 30-foot-round timber pile with 25 to 30 feet sheet piling cutoff walls enclosing outside limit. Drawing Number M-L 12 20/2.
3. Walls: Reinforced monolithic concrete with steel rub bars on their chamberward faces upstream and downstream from the lock gates. Land wall Iowa shore. Intermediate wall is riverward wall of main lock and landward wall of incomplete auxiliary lock. River wall of auxiliary lock ties to dam on west. Drawing Numbers M-L 12 20/4, 20/6, 20/9, 20/19, 20/19; 20/20, 20/28, 40/1.
4. Structural System: See above.
5. Bullnoses: Concrete configurations at each end of intermediate wall. Drawing number M-L 12 20/19.
6. Upper and Lower Guidewalls: Extended monolithic reinforced concrete walls extending the landwall out of the lock chamber at either end to assist guiding of barge traffic into the lock. Drawing Number M-L 12 20/11.
7. Stage Recorder: Small concrete housing located at the end of the downstream guidewall. Equipment housed for the recording of river stages.

C. Mechanical Equipment:

1. Tainter Valves: Four cable drive lock valves of steel construction with electric motorized assembly. Valves are located in wells in lock. They are operated by switches in weatherproof control cabinets

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with a cabinet beside each gate recess. Control cabinets on landwall surrounded by metal and glass shelters since mid-1970s. Drawing Numbers M-L 12 25/11, 28/1, 20/12.

2. Gates: Two pairs of miter gates on main lock and one pair on upstream end of incomplete auxiliary lock. All three pairs are balanced on stainless steel pintels. Those in main lock are operated by arms, gears, and electric motor assemblies. Motor assemblies originally housed in machinery pits in lock walls adjacent to each leaf. Machinery pits for main lock machinery covered by raised concrete, metal and fiberglass enclosures in 1983. The gates are operated by switches in control cabinets. Bumper lines of chamber face of gates also of stainless steel. All other associated metal parts are of steel, stainless steel, or steel/nickel alloy. Drawing Numbers M-L 12 21/1, 21/17, 22/1.
3. Lighting: Various freestanding single and double head lighting standards, installed in 1984.
4. Plumbing: Lock is watered by the Tainter valves (see above) serving a system of cast-in-place tunnels that enable the water level to be controlled on the interior of the lock.
5. Haulage Unit: Motorized winch assembly to assist towing of barges through lockage. Replacement units were installed in the mid-1970s.
6. Traveling Mooring Kevels: Two large cleats on rails which extends the length of both the upstream and downstream guidewalls. Installed in 1980, the kevels are used to assist towing of barges through lockage.

D. Other Elements:

1. Auxiliary Lock: Fixed miter gate without machinery and partial walls are located riverward of the main lock. It is equipped with wells for machinery placement, but was never completed or put into service. Drawing Numbers M-L 12 20/1, 20/5; 40/1.
2. Boat Launches: Built ca. 1970, the launches are single-armed derricks of metal construction.

PART III. TECHNOLOGICAL INFORMATION--MOVABLE SECTION OF DAM

A. General Statement:

1. Design Character: Combination roller/tainter low dam system design. Drawing Number M-L 12 40/1.

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2. Architectural Character: 2b roller gate piers. Drawing Number M-L 12 40/2.
3. Condition of Fabric: Excellent.

B. Description of Exterior

1. Overall Dimensions: 1,049 feet in length. Drawing Number M-L 12 40/2.
2. Foundation: 30-foot-round timber pile with 25 to 30 foot sheet piling cutoff walls enclosing outside limit.
3. Pier House Walls: Monolithic reinforced concrete. Drawing Numbers M-L 12 41/1 and 41/2.
4. Structural System: Monolithic concrete/structural steel.
5. Fenders: Concrete fenders located at the base of each pier.
6. Openings:
 - a. In Overall Structures: 10 water-channels and 2 archways; clustered in groups by sizes, west to east--3 water-channels ca. 60 feet wide; 3 water-channels ca. 100 feet wide; 4 water-channels ca. 60 feet wide; 2 archways ca. 60 feet wide. Drawing Number M-L 12 40/1.
 - b. In Pier Houses: 1 doorway, 1 floor hatch, and 11 three-pane windows for each of four pier houses. Drawing Number M-L 12 40/2; 41/4.
 - (1) Doorways and doors: 4
 - (2) Windows: 44
 - c. In steel diaphragm section of roller gate piers: 1 doorway and door in each of four steel diaphragm sections. Four doorways and doors. Drawing Number M-L 12 40/2.
 - d. In Access Tower: 2 doorways and doors. Drawing Number M-L 12 40/4.
7. Roofs:
 - a. Shape, covering: Pier houses have flat roofs covered in membrane/tar composition. Drawing Number M-L 12 41/3.

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- b. Towers, abutments, piers: 2 abutments; lockwall abutments includes access tower; 11 piers (7 tainter gate piers, 2 2b-style roller gate piers, 2 2b-style transition piers or combination tainter and roller gate piers, and 2 service bridge extension piers); 4 2b-style piers have pier house towers. Drawing Numbers M-L 12 40/1, 40/4, 40/17A, 40/3, 40/2, 40/10, 40/11, 40/13, 40/25.

8. Service Bridge:

- a. Shape: Arched spans in a segmental series.
- b. Materials: Structural steel. Drawing Number M-L 12 53/1.

C. Description of General Layout and Principal Elements:

- 1. Access Plan: Simple stairway in the access tower which itself is part of the abutment resting on the riverwall of the auxiliary lock. This stairway leads to service bridge deck where walkway/rail track extends full length of dam. Access to all four pier houses directly off deck. Access to storage yard below easternmost 200 feet of dam by simple exposed stairway at the eastern end of service bridge. Drawing Numbers M-L 12 40/1, 40/4, 40/7, 53/1, 53/9, 53/10.
- 2. Stairways: In access tower--reinforced concrete with pipe railing; at end of service bridge extension--open metal with pipe railing.
- 3. Flooring: In pier houses and access tower--reinforced concrete; on service bridge deck--wooden plank. Drawing Numbers M-L 12 40/4, 40/7, 53/10.
- 4. Wall and Ceiling Finish: Reinforced concrete. Drawing Numbers M-L 12 40/4, 40/5.
- 5. Hardware: Brass.

D. Mechanical Equipment:

- 1. Movable Gates: Seven, 64-foot wide by 20 feet high, 2b-type Tainter gates operated by line shafts and motors housed in installations above each gate; 3,100 foot wide by 20 feet, submersible roller gates operated on tooth track by chain driven hoist machinery located in pier house adjacent to each gate. Drawing Numbers M-L 12 48/1, 47/1, 55/1, 54/1.

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2. Movable Crane: 30-ton vertical lift electric crane with 70-foot boom (replaced in 1980) used for moving parts and equipment. Sits on original (ca. 1937) crane trolley, which also supports additional bridge crane used for lifting emergency bulkheads, etc. Trolley rides on 15-gauge track system running entire length of service bridge deck. Drawing Numbers M-L 12 53/11A, 53/13A, 58/5.
3. Lighting: Fixtures as of times of installation - 1937-38. Rewiring may have taken place over the years--extent is unknown. Drawing Number M-L 12 56/1A.

E. Other Elements:

1. Earth Dike: Five dikes in sequential series--2,750-foot-long non-overflow earth and sand-filled dike with riprap revetment topped with clay and gravel road extending from eastern edge of movable section of dam to 120-foot-long 10 to 1 slope earth and sand-filled transition dike leading to a 1,200-foot-long concrete-covered ogee spillway submersible earth and sand-filled dike, followed by another 120-foot-long 10 to 1 slope earth and sand-filled transition dike. The remaining 3,130 feet of the dam is non-overflow earth and sand-filled dike with riprap revetment topped with clay and gravel road extending from second transition dike to Savannah Army Depot. Drawing Numbers M-L 12 40/1, 52/1, 52/2.
2. Emergency Bulkheads: Temporary block units of riveted structural steel girder construction placed in gate openings in periods of emergency or repair. Drawing Numbers M-L 12 58/1, 58/4.
3. Emergency Bulkhead Car/Tracks: Located in storage yard, the flat cars designed to store and access bulkheads. Drawing Number M-L 12 53/12A, 40/24A.
3. Storage Yard: 200-foot-long area extending from east abutment under service bridge extension, i.e., under last two archways in dam. The yard contains replacement parts for gates, bulkheads on track cars and related items. Drawing Number M-L 12 40/24A.

PART IV: TECHNOLOGICAL INFORMATION--ESPLANADE AREA

A. Description of Esplanade--General Layout:

1. Design Character: Standardized park/service area and access road component. The main esplanade area has an overall width of 162 to 179 feet from the face of the lock wall and an overall length of 1,262 feet. It was originally designed to accommodate the Central

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Control Station, Lockmaster and Assistant Lockmaster Residences, parking, and other service-related functions. Major site alterations have occurred since that time and are noted in the following items.

2. Architectural Character: 1b Central Control Station. Drawing Number M-L 12 70/1.
3. Historic Landscape Design: Based on standardized designs--see drawings for Esplanade and Lockmaster's residences. Drawing Number M-L 12 38/1.

B. Condition of Site and Structures: Altered

1. Central Control Station - Exterior: Standardized 1b construction. Major alteration in 1985-86 rehabilitation project placed insulation and face brick over original concrete finish. For original, see Drawing Number M-L 12 70/1. Drawings for rehabilitation available from Rock Island District Office.
 - a. First Floor: Contains machinery room where central control panel is located, bathroom, main office, and basement stairway access. Standby generator which dominated machinery room removed in mid-1970s. Drawing Number M-L 12 70/2.
 - b. Basement: Contains storage and equipment rooms. All interior finishes altered from original construction. Drawing Number M-L 12 70/2.
2. Lockmaster's/Assistant Lockmaster's Residences (standardized, Colonial Revival with side porch): The structures has been moved off site. All related structures except garage have been demolished.
3. Outbuildings: Various sheds and service buildings have been erected from time to time as demands required--none have particular significance or contribute to the site. A metal emergency generator building was constructed just upstream from the Central Control Station in the mid-1970s. It is a standardized element. A new garage structure of brick and steel was erected on the old site of the Lock Master's residence ca. 1980. This element is also standardized.

PART V: SOURCES OF INFORMATION

- A. Original Architectural/Engineering Drawings: Mississippi River Lock and Dam 12, lock, operations folio; February 1936, Mississippi River, Lock and Dam 12, dam, operations folio, February 1936, file No. GP58-1; Mississippi River, Lock and Dam 12, Lock Keeper's Dwellings, operations folio, April

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1940, file No. GP58-11; and Rock Island District Office-Construction Drawings--Mississippi River Locks and Dams 1937-1986, (passim), Rock Island District Library, Clock Tower Building Annex, Rock Island, Illinois.

- B. Early Views: Over 1,800 high quality 8x10 black and white construction photographs: Lock and Dam Number 12-Photo Book groups 1210, 1225, 121.9 (6 vols.), and 1280, Rock Island Arsenal, Rock Island, Illinois.
- C. Interviews: Present and past personnel--Lock and Dam Number 12, Bellevue, Iowa.
- D. Bibliography:
 - 1. Primary and unpublished sources: National Archives Record Group 77, Entry 81, Chicago National Archives and Records Center; National Archives Record Group 77, Entries 111 and 112, Washington National Records Center, Suitland, Maryland; Chief of Engineers Annual Reports, 1927-1987; see also bibliography in HAER No. IA-23 narrative history.
 - 2. Secondary and published sources: See bibliography in HAER No. IA-23 narrative history.
- E. Likely Sources Not Yet Investigated: National Archives Record Group 77, Entry 107 (132 linear feet), Washington National Records Center, Suitland, Maryland; National Archives Record Group 77, Entry 1656, exact repository unknown; and National Archives Record Group 77, Entries 608, 609, and 610 (collective total 5 linear feet), National Archives, Washington, DC.
- F. Supplemental Material: 83 film canisters of 1931-1939 silent movies of the construction process taken by the Corps of Engineers, Rock Island District Office, Rock Island Arsenal, Rock Island, Illinois.
- G. Notes: The notes for this outline are contained in the notes section of HAER No. IA-23 narrative history.